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HISTORY AND SOCIOLOGY OF SCIENCE (ON THE NEED FOR AWARENESS ON SOME PERSPECTIVES OF SCIENCE, IN SCIENCE EDUCATION)

by

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1. Introduction

A new awareness and interest has arisen in the history and sociology of science and its interactions with other forms of thinking. This can be seen with the first publication of the periodical *Isis in Belgium in 1913 and later the establishment of the international organisation called the 'The History of Science Society' with its headquarters in the United States of America.

According to history, science and philosophy were to the Greeks one and the same thing, and in the Middle Ages, both could not be seperated from religion. The use of the experimental methods in studying nature only began after the Renaissance. It brought about the split between science (known then as natural philosophy) which was based on Newtonian Physics, and philosophy. In the hands of philosophers such as Kant, philosophy then became and idealist philosophy, far removed from science. However, doday, biological evolution, as well as developments in modern mathematics and physics have deepened scientific thought and forced philosophers to take science which now has philosophical, religious and social implications, into consideration.

Scientists who often assume that they are going in the direction of absolute reality, are now starting to see the real nature of their efforts. The scientific method is an analytical method which gives as far as possible, explanations regarding phenomena in the form of physical concepts. But the fundamental concepts of the physical sciences today are only mental abstractions to enable us to give order and simplification to what looks like unrrelated or disorderly phenomena.

Because of this the scientific approach to reality cover only a few aspects of that reality. That is to say, the picture given is not based on actual reality but only a few simplified abstractions. However, this is not to say that the traditional pure sciences should loose their importance, for even the philosophers have admitted that in a metaphysical study of reality the results obtained through the methods of science still provide the most important evidences, and that respect for the tradition of specialisation in every area of science must be maintaind as the emphasis on all of them is necessary and valid. Nevertheless this should not be followed by an indifferent attitude towards the changing of time, as well as the flexibility and the form of a new field which has just been established, as a result of steps being taken in the form of interdisciplinary approaches. This will prevent the pure sciences from becoming indifferent, insensitive and what is more important, unable to face the many crises in our life which science is able to do.

Hence first and foremost the need for such a discipline as the history and the sociology of science has arisen out of the realisation of the scientists on the one hand, and the humanists such as the philosophers on the other of the inadequacy of either field alone (especially more so in the case of science) to fulfill the need of man to understand the world and himself fully, and satisfactorily. It has also arisen out of the realisation that increasingly, specialisation especially in the siences has developed to such an extent that no longer can coherency exist in the totality of man's understanding of himself,

* An International Journal for the History of Isis.

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and what is more important his ability to cope with the problems that he faces.

In the following section other rationales for the introduction of such perspectives of science in the science curricula will be presented.

2. A few rationales for the introduction of courses such as the history and sociology of science.

2.1. From the point of view of education

A good ecucation (science education in this case) does not only correspond with a system that specialises and has as its goals the making of experts in a particular field with the specific knowledge and skill that it entails. In fact a satisfactory educational system, especially at the university (from the word "universal") level must not only be able to produce experts but also a person who has a broad view, one who can see the connection between his own field of study and the wider spectrum of human knowledge and activities. Only with the existence of this wider perspective in the science curricula can we produce scientists who are responsible towards the use of science and scientists who are sensitive to the problems that science can potentially create within society and the environment.

2.2. Career

When a science graduate begins to work, he will find that the working environment is different from the educational institution that he had just left. Here he will be expected to have interactions with society at large, and not just with the academics. Most of the members of this society would consist of laymen who would not understand science in its technical written and spoken forms. They would want to know about science and scientific know-how is a language easily understood by them. This would perhaps require the knowledge and skill of an arts or sociology student, i.e. one who other than being able to think about a technical problem, is still capable of presenting it in a general but precise way. It is only through this mean that a relationship can exist between the scientist and the members of the non-scientific society, and an understanding of the characteristics of scientific knowledge, the scientific approach as well as the limitations of science be understood. Only after all this have been achieved can we hope to realise our desires to carry out projects that are directly or indirectly connected with science more effectively.

2.3. From the poit of view of forming a national science policy

There is no national science policy in Malaysia so far, even though vibrations of efforts made in that direction have been felt lately. Activities in science now exist isolated from each other without any policy uniting and giving them direction. No coordination exists for example between the educatinal sector, the government research centers such as MARDI, IMR and the industries. In order to facilitate the drawing up of a national science policy we need to know how science arose and developed in the western nations for eg., so that we may draw up guidelines as to what should be followed and avoided respectively. This task must be thought about by every scientist in our nation and the thinking must start whilst they are still at their tertiary institutions. There are many other rationales that can be thought of but for the purposes of this short paper the above should suffice as "openers".

3. Possible course topics

Having had some ideas as to why the subject discipline has come into prominence let us now look at some of the topics that a course in the history and sociology of science could cover.

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3.1. Science from a historical perspective

It is one thing to learn a piece of science or to do some scientific research; It is quite another thing to ask what is science? What were the worldviews that gave rise to it? What assumptions underlie the whole enterprise? How did science develop into the most influential institution as can readily be perceived today? What 'external' factors have influenced its growth? History courses may be concerned with questions of the latter sort, and treats them in a concrete and detailed way. It proceeds by looking at the earliest civilisations and forms of scientific activities. By making a chronological division of the whole known history of science it can be shown for example that the development of science has been and still remains quite intimately related to the changes and development that occur in other of man's life. It can be demonstrated for eg. His changing world-view (how he views himself and his relationship with the universe); his religious perceptions, political conflicts and economic considerations area among some of the inextricable components in the growth of science.

In the context of multiracial Malaysia, one innovation that could be made in the history of science course (such as that taught to the students at the Univ. of Malaya science faculty) is to look at and examine other forms of science besides the western one. These other forms include Indian, Chinese and Islamic science respectively. The nature, contents, methodologies and philosophies behind them are examined and compared to their western counterpart. Not only can this approach help in the student's search for and better understandi of their roots respectively, it is hoped that it could also help to foster greater feelings of understanding and respect towards each other's heritage.

This approach too can help students to see (in a broad sense at least) how each civilisation's science has taken or given elements of it's own indigenous knowledge to the others; and finally it can be seen how western science is actually an expanded growth (or an explosion of growth would be more fitting perhaps) of all these earlier endeavours; which has finally passed to the western world through the Islamic civilisation just before the Renaissance. Hence perhaps then it can be seen that science is not only synonimous with the west and that the metaphysical and cultural seeting of it need not be entirely western either. This perhaps could help clear the way for our own indigenous science to be developed.

Another 'Malaysian' aspect of this course could also be from the point of view of the country being a developing one. We all know science and technology is supposed to be one of the most important means in our development strategies. In this we should take need of the lessons learnt by the west in its longer history of its utilisation. In addition, here is also the need to answer questions like how should we cope with conflicts that may arise as a result of the confrontation of science and traditional beliefs for example. This is certainly not an absolete problem as evidences for it can still be seen from examples such as the 'bertepong tawar'* ceremony that is performed by a 'Yang Berhormat'** on brand new Jumbo jets, a new Combine harvester or ocean liner say.

From the educational point of view there is also evidence that this cultural confrontation can give rise to serious difficulties in the reception of science amongst rural school children (a collegue has recently made studies on this problem, and he has shown it to be a significantly real problem). All the more then, is there a need, an urgent one, for science to be understood in its cultural and social contexts. We have yet to look into the matter of science-religious conflicts as well.

*Literally neutralising water to neutralise evil influences.

**Literally 'the honourable' a person of high status in society.

The course could also include a section devoted to relationships between science and ethics and religion respectively. In this some attempts to derive ethical principles from the practice and content of science could be discussed - as are the notions that we have an obligation to serve a good life for future generations (in the context of genetic engineering say, and the environmental crisis).

3.2. The nature and social context of scientific activity

Most people are used to thinking of science as a body of knowledge, or as a way of investigating the natural world, yet it can also be thought of as an activity of people - that is as a social and cultural phenomenon. We could say that science is one of the youngest major social institution. Its youth is perhaps one reason why it is so easy to underestimate its present size and significance. The point of studying science as a social phenomenon is perhaps more readily seen if we remember its cost, its numerical strength and its involvement with other institutions. In some western countries a considerable proportion of the gross national product is spent on scientific research alone and a large portion of their system of higher education consis of students in or science - based courses, and many kay industrial processes require scientifically trained personnel for their operation.

Yet very few people are interested in science as a social phenomenon, or in the interaction between science and the wider society. A course on the sociology of science could then look at science and society from a sociologic perspective and attempt to show how sociological findings and theories can throw light on their relationship. Some of the questions asked may include:- How does science influence society generally? How do scientific discoveries influence technology and hence the economic system? How do scientific theories and concepts influence different races or cultures? What influence do scientists have as experts on practical matters?

In attempting to answer these types of questions, concrete studies of science and commentaries upon it are examined, as well as more general work on human attitudes, theories of political ideology, the operation of pressure groups, the role of the mass midia in society, thinking in non-western or traditional societies and other general topics.

4. Summary

In summing up therefore, studies such as the history and sociology of science aim at amongst others, to explore the nature of scientific thought, the origins and developments of scientific concepts, the metaphysical components of theories and the existence, interaction with as well as the implication of science on various societies and civilisations in the past and present. Of course for a more thorough and comprehensive discourse of the above issue another component called the "philosophy of science" is also necessary. However since my colleague Prof. Madya Vance Hall have already or will be touching on it I shall not duplicate his efforts here.

It is hoped that such studies could then create an understanding of what it means to think scientifically (covered especially in the philosophy section) and the ways in which scientists tackle their problems. This as well as a comparison of science with the world-view of a culture plus the knowledge of the effects of the activities of scientists and technologists on society would provide in no small measure a greatly needed contribution to our society that seeks the hand of modern science and technology.

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5. Conclusion

To its advocates, the special position of history and philosophy of science as a field of impinging and interelated studies where different disciplines converge and where converging insights are necessary, represents the most important reason for its inclusion in university curricula. It is also their hope that the widespread introduction of courses in the subject would counteract the effects of the current isolationast trends among the scientists and humanists.

We must get rid of the habit of being satisfied with what we are already familiar with and also the refusal to widen our horizons of knowledge.

Note

It is significant to note that the need for this new discipline has been increasingly felt by many scientists quite independently of each other in the country today besides the group who are already teaching it at the science faculty, Univ. of Malaya. One may quote the following articles for example as evidence of the above.

1. Prof. Shaharir Mohamad Zain "Peranan sejarah sains di dalam pendidikan sains dan matematik", Suara Sains, Jun-Okt 1983 pgs. 1-2 Univ. Keb. Malaysia.

2. The National Science Council for Scientific Research and Development, Bull. Sci. & Tech. Malaysia, 2, (1) March 1983 pg. 10, K.L.

3. Rajakumar M.K., "Science as a way of life", Bull. Sc. & Tech. Malaysia 2 June 1983 pgs. 6-7, K.L.

Such courses are also already underway in many European nations including the United States, Australia and New Zealand. Among the developing notions countries like India and Pakistan, and now Malaysia are taking the lead.